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Socially responsible or reprehensible? Investors, electricity utility companies, and transformative change in Europe

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ABSTRACT

The overwhelming reliance of modern society based fossil-based non-renewable sources of energy production represent a major challenge to sustainability. Moving towards a new more sustainable generation mix affects investments on electricity utility companies. This presents a dual challenge for companies: 1) the electricity generation mix decision; and 2) their future access to and cost of capital. This research focuses on the role that investors have in developing new more sustainable generation mix models. Five semi-structured interviews were conducted with investors working at a major European asset manager company. The interviewees highlighted the integration of renewable technologies as a key challenge to the viability of the utilities in the future. Other key challenges included a rising carbon price, greater decoupling of energy use and GDP growth, policy constraints and uncertain regulatory frameworks, lack of relevant core competencies to innovate in their business models, the integration of renewable energy into their own generation mixes and the grid, the role of new technologies, and a lack of urgency from top management. The findings indicate that investors play a key role in shaping electricity generation mixes, where the principal, agents, and clients must be willing to develop and adopt more sustainable generation mix models.

1. Introduction

In 2012, 86.5% of the world's total primary energy supply was based on non-renewable fossil fuels such as coal (29%), oil (31.4%), natural gas (21.3%) and nuclear (4.8%). European OECD countries were responsible for 32.7% of total primary energy supply [1]. Electricity production accounts for the largest share (31%) of anthropogenic greenhouse gas (GHG) emissions [2], whilst nuclear, although technically emissions free, comes with issues such as security, waste disposal, and the potential for catastrophic environmental damage, as in the case of the Fukushima disaster in Japan [3]. The overwhelming reliance on high carbon, high polluting, non-renewable sources of energy production represent a major challenge to sustainability [4]. More sustainable models of global energy production, based on renewable energy, have become necessary in combating climate change and resource depletion [5,2,6].

A number of plans to reduce greenhouse gas (GHG) emissions have focused on the energy sector, with national and international policy ambitions for reducing GHG emissions, coupled with low carbon technology deployment, to achieve the required energy transformation [7]. In 2007, the EU set up a new policy framework to become a highly energy-efficient, low carbon economy [8]. When it came into force in 2009, the new legislative framework presented a number of large challenges to the electricity utility industry [9], such as: (1) the development of targets for renewable energy; (2) the cost pressure and aging of conventional power plants; and (3) the change in customer interests and their bargaining position [10]. To address these challenges, and achieve a transformation to a more sustainable global energy sector, utility companies require new models of energy generation that incorporate greater levels of renewable capacity, whilst remaining competitive in the new energy landscape [11].

Many investors have been integrating sustainability in their investment decision-making process [12], which directly affects investments in the energy sector [13]. The success with which a utility company can make such transitions affects how investors perceive the viability of investing in it [14]. Despite this, there is still limited research on the role of investors on energy utility companies' transition towards becoming more sustainable, how the investors respond to sustainability challenges, and how their views may affect a utility company's access to capital for each of their generation models. This paper aims to explore the role sustainability investment has in transitioning to more sustainable generation models, particularly through the

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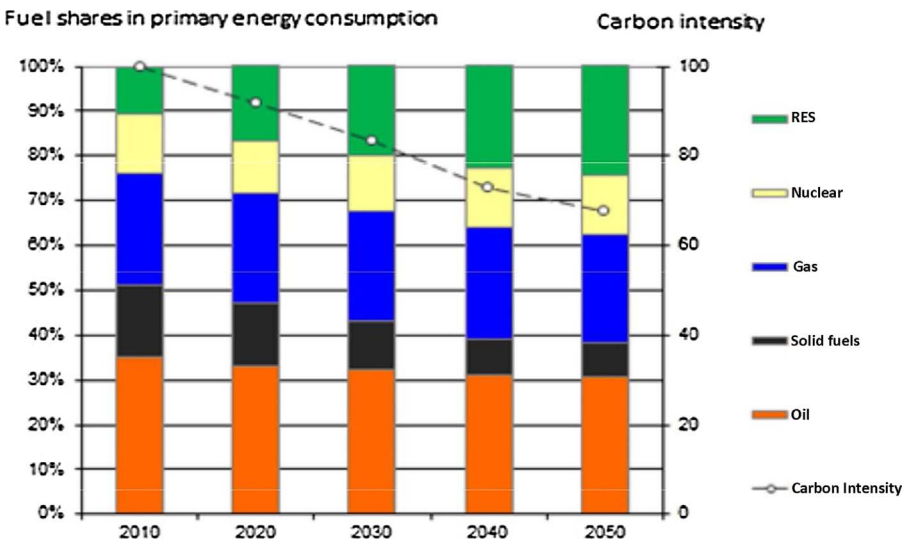

Fig. 1. EU-28 Fuel shares in primary energy consumption, carbon intensity.
Source: European Commission [64].

perception of investors on the European electricity utility company sector's access to capital.

This paper is structured as follows: Section 2 reviews the literature on environmental challenges for the European Electric utilities sector, sustainability oriented investment, and agency theory; Section 3 presents the research methods used; Section 4 provides the findings; Section 5 presents the discussion; and Section 6 focuses on the conclusions.

2. Literature review

Global challenges to produce sufficient clean and cheap energy for the world's population has led to governments beginning to implement targets for renewable energy adoption and carbon emission reduction [15]. For example, the European Union's 2020 Climate and energy package specifies a 20% reduction in EU greenhouse gas emissions from 1990 levels, raising the share of EU energy consumption produced from renewable resources to 20% (up from 8% in 2013), and a 20% improvement in the EU's energy efficiency by 2020 [8]. Compliance with new forms of environmental regulation tend to increase a firm's costs [16]. Fig. 1 shows the expected trends up to 2030, where the use of renewables doubles.

Certain phenomena are expected that the increase of renewables in the energy mix will radically change the structure of the energy sector, including the way power is produced, transmitted, sold [17,18], and the transformation needed for traditional utilities companies to survive [11]. Critical to the adoption of greater levels of renewable energy technology has been the cost-competitiveness of conventional generation technologies, as well as efforts to keep energy prices low for the consumer [19]. Nonetheless, due to the increasing commercialisation of renewable technologies, some alternative energy generation technologies, such as wind and utility scale solar Photovoltaic (PV), have become cost competitive against traditional generation technologies such as coal, nuclear, and Gas Combined Cycle [20].

2.1. Challenges to the electricity utility companies

Despite increasing levels of adoption of renewable energy mixes, the volatility of renewable energy production faces two main challenges: 1) balancing supply and demand; and 2) traditional utilities plants being operated at less than their full capacity [10]. Forecasting renewable generation amounts is becoming more important, whilst new capabilities are needed for grid and power plant generation and electricity trading to balance supply and demand under increasing rates of more volatile renewable energy [21]. The rise of renewable energy has also had the consequence of causing the larger, traditional fossil fuel power plants to be operated under partial load for long periods, due to the priority given to renewable energy on the grid, meaning they are unable to reach their fully efficiency and earning potential [10].

The European Union Emissions Trading System (EU ETS) has also increased pressure to the energy sector. This system was designed to 'promote greenhouse gas reductions in a cost-effective and economically efficient manner' [22]. It is aimed at reducing carbon emissions by allocating a financial cost to those who emit them [23] in the form of European Union Allowances (EUAs). The system is the biggest international system for trading greenhouse gas emission allowances and covers more than 11,000 power stations and industrial plants in 31 countries [24]. The EU ETS is built on the principle of 'cap and trade', where companies receive or buy emission allowances that they can then trade with one another as needed within the total number of permits made available by the government. If a company emits more than it has permits to cover, heavy fines are then imposed [25]. The direct financial impact of carbon pricing schemes on utility companies is still unclear [23], and may not provide strong incentives for low-carbon investment. Nonetheless, increases in carbon dioxide prices are likely to negatively affect companies with large amounts of thermal generation in their portfolios, as it becomes more expensive to emit carbon [26].

Utility companies' access to capital is another key challenge in ensuring a successful sustainability transition [27]. Although large investments have been made in recent years to transition the sector towards a more sustainability orientated state, the International Energy Agency (IEA) estimates that an additional investment of $7.6 trillion through to 2040 will be required from countries in the Organization for Economic Cooperation and Development[1] (OECD) to meet the rising challenges apparent in the sector [27]. Europe's electricity utility companies must adapt to changing market conditions, and the success with which each company can transition to a more sustainability orientated state markedly affects how investors view the viability of investing in each company [14].

Although most major asset and fund managers have introduced specific sustainability funds for specific clients, the explicit incorporation of environmental, social, and governance (ESG) criteria into a mainstream portfolio selection method is a relatively new trend [28]. For example, €7 trillion of professionally managed assets were excluded by investors on sustainability grounds, whilst ESG criteria were integrated into decision making on around €5 trillion of professionally managed assets, and engagement and voting on sustainability issues

[1] The European Union is a part of the OECD, and thus is affected by such investment requirements.

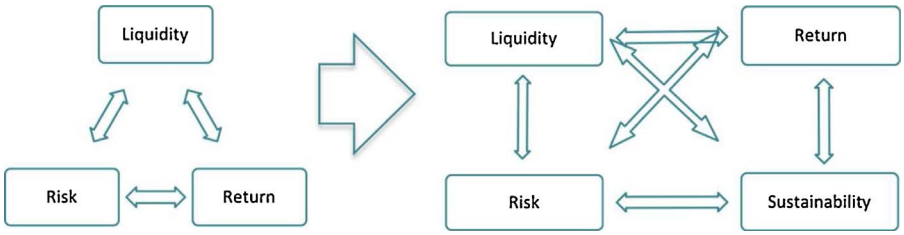

Fig. 2. Investor needs in the investment process [29].

implemented on around €3 trillion of professionally managed assets in the European Union [12]. Investment decision-making has, traditionally, followed a simple triangle of liquidity, risk and return [29].

2.2. Explaining the role of investor as sustainability change facilitators through agency theory

Traditionally, there has been pressure on public companies from financial markets to maximize short-term results [30]. Sustainability is challenging such positions, especially when investors, with significant and long-term holdings [31], are concerned about their client's actions [32]. Investors promote change within a sector through the allocation of capital due to raised environmental ratings, leading to an increase in return on assets [33].

An increasing number of investors have begun to integrate environmental, social and governance criteria into their investment decision-making process [34,12,35], creating the so-called 'magic square' representing the inter-linkages between sustainability, liquidity, risk and return (see Fig. 2). By integrating the long-term perspective, investors are increasingly addressing the four dimensions of sustainability – economic, environmental, social, and time (see [36,37]). In the context of ESG, the integration includes: social performance (e.g. employment quality, safety and health, training and development); environmental performance (including emissions reductions, resource reduction, and product innovation); economic performance (such as client loyalty, performance, and shareholder loyalty); and corporate governance performance (including board structure, compensation policy, and vision and strategy) [38]. Nonetheless, the literature on investors' preferences towards investments in renewable energy sources or wind energy is still scarce [13].

European electricity utility companies, covered by the EU ETS, show significant exposure for investors, due to buying carbon dioxide emission allowance carbon risks [39], and the uncertainty surrounding the implementation of the EU ETS [40,41]. Extremely high-emitting utility companies bear significant risk premiums for carbon and higher capital costs [39].

Polluting firms have been excluded by some investors, leading to a lack of risk sharing, lower stock prices, and an increased cost of capital for these firms [42]. Being excluded by some investors using environmental screens leads to a significantly higher cost of capital for these firms [34]. The environmental management of public corporations has credit risk implications for bond investors, as environmental practices affect the solvency of borrowing firms by influencing their exposure to expensive legal, reputational, and regulatory risks [43]. Given such pressures, it is in the interest of the utility and its investors that utility companies decrease potential risk exposure [44], which could be achieved by 'greening' their generation mixes through the adoption of renewable generation capacity. Conversely, short term investors who do not pursue sustainability strategies and favour short term holdings in companies have the opposite effect, sometimes at the expense of longer term, sustainable performance [45], and thus, utility companies that do not act to decrease this risk exposure are likely to be punished by the market.

Agency Theory (AT) can help to understand the relationship between electricity utility companies and their investors in the transition to become more sustainable, and the influence that sustainability oriented investors may have on the firms in which they invest. AT, as a specific case of Contractual Theory [46], focuses on the agency relationships between the principal, or principals, who engage and transfer authority, and the agent, who performs a service on behalf of the principal(s) [47]. AT has been applied to understand the relationships in a multitude of different scientific fields, including economics [48], finance [49], and in behaviour and organisational culture [50]; however, its application to sustainability investment has been limited. AT highlights the need for long term investors to structure incentives so that company managers and their respective strategies are in line with the long-term interests of the principals [47]. AT also highlights the responsibility of boards in ensuring that managers make decisions that provide long term sustainable value [51,52].

In the agent/principal relationship, problems may arise due to diverging interests, such as: the agent does not always act in the best interest of the principal i.e. problems between ownership and governance [47]; the agent may have limited ability to react under unfamiliar situations, or in unstable environments [53]; and as information asymmetry exists between the principle and its agents, the possibility exists for agents to act opportunistically, in their own interests rather than those of the principals [51].

3. Methods

Five semi-structured interviews were conducted with investors working at a major European asset manager with over €250 Billion in assets under management, who have day-to-day involvement in the utilities sector. The number of interviewees was limited by access to the companies, which tends to be extremely limited in the finance sector. An asset manager offers a number of active and passive investment strategies, from equity markets to government bonds or private equity, the asset manager actively integrates sustainability factors into their core investment strategies, in the belief that this will aid the long-term outperformance of these strategies.

Due to confidentiality issues and a binding non-disclosure agreement, the name of the asset manager and the interviewees cannot be disclosed.

Under the conditions for the research, the authors of the paper were given access to the interviewees listed in Table 1. The interviewees were involved the investment decision-making and management process for investment in the European utilities sector, and all had at least 10 years' experience of working in the investment industry. Within the sample, two of the interviewees were involved in engagement work with utilities companies, two worked as sustainability analysts on the sector, and one of the interviewees covered the utilities sector from a credits perspective (see Table 1). Four interviews were face-to-face, and

Table 1
Investors Interviewed for this research.

Investor	Role	Experience
A	Engagement Specialist	> 25 years
B	Engagement Specialist	> 10 years
C	Sustainability Analyst	> 10 years
D	Sustainability Analyst	> 10 years
E	Credits Analyst	> 15 years

the other via a video link.

The questions were based upon investors' perceptions of the utilities sector and sustainability. The interviews were transcribed, coded using themes from the literature reviewed, and open-ended ones that emerged from the data, and then explored for cross interview patterns. The data gathered through the interviews was analysed with Grounded Theory (GT) [65]. GT was developed as a response to the lack of effective tools for theory discovery [54], and concerns over the predominance of quantitative methods in the social sciences, and the tendency to test existing grand theories [55]. GT is a strategy that emphasises developing and building theory from data and observations [54–56,59]. It was designed to close the gap between theory and empirical research [54]. GT helps to frame research that is exploratory, where the researcher has little control over the phenomena being studied (in this paper, the role of investors in the electricity utility companies' transition to sustainability). It also permits the researcher to be able to detect if there are causal connections between variables, and to generalise from a specific context [57]. The initial framework for analysis was done in the context of: (1) the four dimensions of sustainability (see [36,37]), economic, environmental, social, and the time dimension; (2) Agency Theory within the context of the electricity utility companies; and (3) the factors that influence investors when deciding to invest in a particular company and business model. Rather than using predefined categories, which would limit themes which could be derived from the data, the analysis of the data was aimed at producing open ended categories to enable the subject to be researched in its entirety (based on [56]). This was then used to identify and develop patterns and themes from the data.

According to Hussein et al. [58] the advantages of GT include: provision for intuitive appeal; fosters creativity; potential to conceptualise; systematic approach to data analysis; and provision for data depth and richness. Whereas the disadvantages include: exhaustive process; potential for methodological errors; review of the literature without developing assumptions; multiple approaches to GT; and limited generalisability. GT, when compared to other methods such as content analysis (see [55]), provides a considerable systematic and deep analysis of a small sample without having to look into the details of sentence construction, as in the case of discourse analysis (as discussed by Jupp [55] and Saunders et al. [59]), or entering the complications of interpretative analysis of hermeneutics (see [60,61]).

For this research, reliability (see [59]) might have been affected by:

- Subject or participant error: the limited time available for the interviews, which may not have allowed to enable them to expand upon some of the interview's questions;
- Subject or participant bias: the interviewees might have provided answers that were guided by the semi-structured interview, or by the positive sustainability attitudes of the interviewee. Another potential bias is that investors will consider investments more important than technology or policy issues;
- Observer error: This was reduced by applying a semi-structured interview;
- Observer bias: The shared concern of this paper's authors and the interviewees to sustainability, which might not have been applicable if another researcher or other companies, or other interviewees had been approached.

Some of the limitations of the methods include: gaining sufficient access to data was a major limitation of this study, due to the specialised nature of the utilities sector and the knowledge needed to invest in the sector, which may affect the generalisability of the findings (see [55,59]); being able to get only five interviews, due partly to a limited number of investors involved in the day-to-day investing process for companies within the utilities sector, as well as to confidentiality issues demanded by the investors; the potential bias of the observer and participants' interest in sustainability issues; and GT's focus on data and context, which may not allow for full generalisability of the findings to other contexts.

4. Findings

Four of the respondents indicated they saw the integration of renewable technologies as a key challenge to the viability of the utilities in the future, the highest number for any of the challenges identified. The challenge was two-fold: firstly, through increasing the percentage of renewables within the utilities own generation mixes; and secondly, balancing ever greater peaks and troughs in supply, which is a direct result of the intermittency of renewables generation.

The respondents identified the following challenges to the utility companies: a rising carbon price placing downward pressure on the company's earnings before interest and tax (EBIT) and therefore their ability to invest; the decoupling of energy use and gross domestic product (GDP) growth due to energy efficiency measures; policy constraints and uncertain regulatory frameworks around the use of greater levels of renewable energy; many utility companies lack the relevant core competencies necessary to sufficiently innovate their business models; challenges around integrating this renewable energy into their own generation mixes and the grid; the role of new technologies such as distributed generation and battery storage; and, a lack of urgency from top management in addressing the challenges present in the sector.

The interviewees highlighted that traditional business and generation models in the sector are changing. All the interviewees identified the need to find new models to allow the utility companies to survive the changes happening in the sector. In addition, the business models must facilitate the maximum amount of renewable uptake possible; however, there was no indication as to what such models would be, or what they would look like.

Three of the respondents mentioned that a utility company should try to remain integrated across the value chain, essentially increasing and expanding their energy services business to cope with new disruptive innovations such as distributed generation whilst 'greening' their operations by adding new renewable generation capacity. This points to a diversified structure that would reduce risks for the utility company.

The interviewees highlighted the lack of capital resources to invest in large amounts of new renewable mixes, such as thermal generation. This was due to the large number of mergers and acquisitions in the energy sector between 2006 and 2007 that forced utility companies to acquire hefty debts, and limited their capital resources to invest in large quantities of new renewable generation.

The investors raised their concerns about some utility companies being unable to finance more sustainable generation mixes, and innovative business models. As Investor A indicated, "*I think there will be a few Kodak [moments]. I really do think some companies will go bankrupt, I cannot see any other scenario*". This can also be seen from the fact that some utility companies have made limited investments in renewables capital expenditure (CAPEX). For example, many companies have a comparatively low percentage of renewables in their generation mix, which will likely be further compounded in the future as they also tend to be amongst the lowest spenders on renewables CAPEX as a percentage of group EBIT.

The investors stated they were hesitant to invest in companies with large thermal generation capacities. As Investor B noted: "*Would I invest if they are long on coal and short on renewables? No I would not, no. I think utilities can still have a decent portion of coal in their generation mix but I think it has to be going down, and even more important I think the carbon intensity overall has to go down, if that's not downward facing I don't think there is an investment case*". This highlights the risk of having less available cash to spend on adding new renewable capacity, which forces a downward spiral as cash flows from traditional generation arms become increasingly squeezed and existing thermal capacity is pushed out.

The interviewees mentioned that a utility company's generation mix plays a large role in the viability of investing in each company. For example, companies with high percentages of coal in their generation mix were not considered as good investment opportunities. Carbon intensity was viewed as the key metric by which to judge companies, and there was a prevailing opinion that these were not good investment opportunities. Whilst, due to the low carbon price, coal is currently profitable, the interviewees were not in favour of its long-term prospects.

Some the investors indicated that the type of renewable energy on the grid is an important factor to consider for utility companies in choosing their business models. This, in turn, affects investor perceptions of each utility company. In this way, generation from renewable electricity can almost be a new 'regulated activity'. In the past, when considering investing in new thermal generation capacity, utility companies could almost be assured of a high load factor for the plants that they built. For example, if they were to build a new coal plant they could be assured that 80% of the power produced would be purchased and consumed over the plant's 30-year life span; however, due to the preference that renewable energy now receives on the grid, utility companies can no longer be certain that any added or existing thermal generation capacity will be used, therefore having a further level of unpredictability to their investments.

In adding new renewable energy capacity, it is expected that load factors will remain high for the foreseeable future, and the energy produced by these plants can be monetised. This allows investing in renewable energy to be perceived as a new 'regulated activity'. If this were the only issue to be considered from an investor perspective, proactive companies in renewable generation would be considered better business models in which to invest, as their high share of renewables in their generation mixes provides them much greater certainty on cash flow.

Overall, the interviewees had a critical opinion of the sector's future. All the respondents highlighted that many European utility companies would see their earnings and long term viability increasingly compromised in the coming years. They also indicated that company strategies would diverge in the coming years as each company pursued differing strategies to adapt to the changing market place. The interviewees mentioned that some of these companies would face likely bankruptcy because of a failure or inability to act on these new business models. For example, one of the respondents highlighted that companies, such as those with large coal generation capacities as a percentage of total generation, already face higher borrowing costs than some of the more sustainable companies. This hints to a downward spiral identified by many sector analysts, whereby investors are less likely to invest in less sustainable, high thermal generation companies, and these companies are not able to raise the capital required to fund the transition towards a more sustainable state.

Traditionally, many investors bought stocks in utility companies because of the customarily high dividends. Since utility companies were traditionally financially strong, it was possible to buy stocks in almost any of the companies and receive a reasonable return on investment. This has been challenged by the sector trends, which have resulted in a growing differentiation of business and generation models. As Investor C stated "*It is definitely not a stable sector anymore. It used to be one of the defensive, very boring, sectors, dividend driven, but it isn't anymore*".

The interviewees indicated that companies with high amounts of thermal generation within their generation mixes were not considered good long term investments, due to the likely effect on their future earnings of stricter environmental legislation, and the predicted future rise in the EU ETS carbon price. Coal was the most negatively perceived part of any of the company's generation mixes, since it is the most environmentally polluting of the mainstream fuels.

The investors stated that any company with a high percentage of coal generation assets or with static or rising carbon intensity should be divested, as they simply no longer represented good investments. An example of this was given by Investor D who compared two companies from the sector: Enegas, which owns and operates Spain's national gas grid, raised bonds at 1.5% interest and represented an almost zero spread between the rates that they and the Spanish government can borrow at (debt costs are usually linked to the sovereign yields); and RWE, which had to raise capital recently through equity issuance or debt at much higher rates than Enegas, despite the fact they are in Germany, where they should have had access to cheaper capital and, historically, their debt would normally be cheaper to service. Firms that have environmental concerns assigned to them pay more for debt financing and have lower credit ratings assigned to them (concurring with [43]). The interviewees also noted that some companies can access cheaper and more readily available capital than others due to, for example, in the case of large coal users, a future rise in the carbon price would represent a greater fall in the percentage of future earnings, rather than those with more exposure to renewables, making the latter more attractive to investors. Many of the large coal generators have a comparatively low CAPEX expenditure on renewables as a percentage of EBIT as compared to many of their peers. In addition, the uncertainty surrounding the load factors of thermal generation assets makes investors sceptical in investing in high thermal generation utility companies, and so "*now load factors are lower, but also much more uncertain, and that means the cost of capital has also increased for thermal generation*". (Investor D)

The interviewees indicated that the nexus between increased sustainability and financial performance relates to access to capital, since environmental concerns may negatively affect the future earnings of the utility companies. This connection is not being considered in the sector, due to a low coal price. Utility companies with high percentages of coal in their generation mixes are doing better than those whose generation mixes are composed of relatively more expensive technologies. In spite of this, the interviewees highlighted that for the mid to longer terms, companies that position themselves on a more environmentally sustainable footing will benefit from increased financial performance.

In summary, the respondents highlighted the following key challenges: the rising carbon price and its effect on earnings; energy efficiency measures leading to a decoupling of energy use and GDP growth; the role of policy and regulatory frameworks; a lack of the core competencies required for operating renewable generation assets; the integration of renewable energy capacity into existing generation mixes; and, the uncertainty around the role of new technologies, such as distributed generation and battery storage.

5. Discussions

The findings indicate that many of the European electricity utility companies will, in the near future, face constraints on access to capital as investors divest from the companies with unsustainable, high thermal generation mixes, and focus instead on what they perceive to be more sustainable models of generation (concurring with [43,34,62]). The insights from the interviewees also underlined that many of Europe's electricity utility companies are becoming increasingly challenged by new technology and policies (as discussed by Busnelli et al. [63], Marko et al. [10] and Richter [11]).

The findings show that there is an agency discordance between the management of European utility companies and investors who own their securities. The investors interviewed mentioned that they do not believe most of the utility companies were sufficiently adapting to changes within the sector, such as those brought about in the EU 2020 climate and energy package. In some cases, this was because management did not appreciate the full scale and pace of changes required. The investors interviewed highlighted their increasing desire that their clients (the management teams of the utility companies) start considering sustainability as an integral part of the longer-term sustainability of their business; however, many utility companies might not be receptive or ready to change their generation models to more sustainable ones,

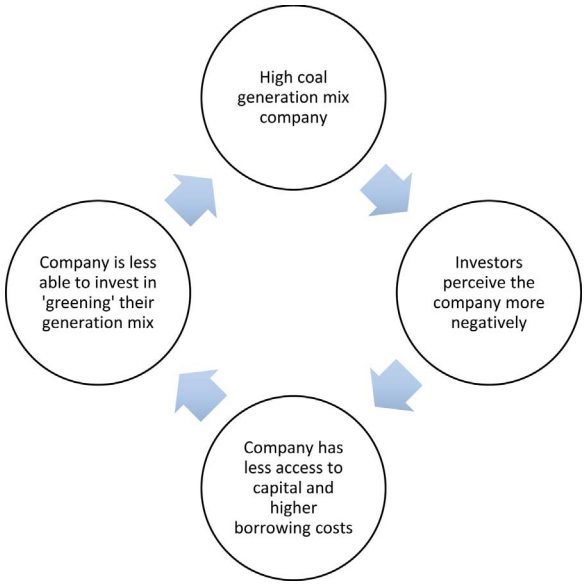

Fig. 3. 'Death spiral' of high coal generation European electricity utility.

thus generating discrepancies between the agent (the investor) and the principal (the utility company).

The negative perception by investors of companies with high percentages of coal in their generation mixes has two main ramifications: 1) if they are to be excluded by investors using environmental screening, or simply because a high carbon price would make them a bad investment financially, then the companies will see their access to capital diminished or become more expensive due to the smaller pool of investors prepared to invest in their businesses; and 2) there is a relationship between environmental policies and access to capital in that polluting firms are excluded by some investors, which leads to a smaller investor base and a subsequent lack of risk sharing, and this, in turn, results in lower stock prices and an increased cost of capital for these firms.

High thermal generation utility companies will be unable to invest in new renewable capacity due to constrained access to capital, which will affect their existing core business due to increases in carbon price leading to a potential "death spiral" (see Fig. 3).

Compliance with new forms of environmental regulation tend to increase a firm's costs (as discussed by Clarkson et al. [16]); however, the extent of this increase in compliance-related costs acts to diminish the returns to shareholders and its relevance for environmental compliance of investors are less clear.

To be successful and sustainable, utility companies must innovate to address the investment, technological, and policy challenges, largely by facilitating the maximum uptake of renewables possible into each utility company's respective generation mix (see [11]). In pecuniary terms, utility companies must balance making their existing coal plants 'greener' by increasing thermal efficiency and not letting this process to stifle investment in new renewable technologies, which will most likely form the basis of the generation part of their future business models.

6. Conclusions

The global energy system represents a crucial challenge to the concept of sustainability and vice versa. The traditional generation models of Europe's electricity utility companies are becoming increasingly challenged by sustainability through technologies for their generation mix and policies. This paper argues that increased compliance costs, in the form of the EU ETS, will negatively impact the financial performance of high thermal generation utility companies, therefore making them less attractive to investors and in turn restrict access to capital for these utility companies. On the other hand, considerably large investments will be required to make the sector more sustainable. New generation models are required for this, where investors have a key role in funding innovation and achieving such changes for the energy sector.

This paper explored the role sustainability investment plays in transitioning to more sustainable generation models, particularly through the perception of investors on the European electricity utility company sector's access to capital, which complement the discourses on policy and technology towards making the sector more sustainable. The paper focuses on the agency relationships between electricity utility companies and their investors through interviews with five asset managers. Although the agent might be acting in the best interest of the principal, utility companies might not be receptive or ready to change their generation models to more sustainable ones.

The paper proposes that any constraint on access to investment capital may lead to a 'capital death spiral' that high thermal generation utility companies will have to face in the coming years. This looming 'capital death spiral' shows that investors are increasingly taking into consideration renewable generation capacity, core competencies for future renewable development, technological challenges, and policies, when investing in electricity utility companies. This has direct implications for companies with unsustainable generation models, since capital resources will not be available in the future. By not engaging with sustainability, a number of European electricity utility companies are likely to face bankruptcy, as their income streams become compromised by technology and policy challenges that affect investments, and increases the hold of the 'access to capital death spiral'. This would be financially detrimental for the utility companies and their investors.

It is important that investors and utility companies collaborate to develop new sustainable generation models for the future, which will counter the potential for accessing a capital death spiral. For this to take place, the principal, agents, and clients must be willing to develop and adopt more sustainable generation mix models.

The findings of this research indicate that investors play a key role play in helping the utility companies sector transition to becoming more sustainable by encouraging (a maximum) uptake of renewable energy generation technologies. The adoption of new sustainable generation models, for which investors are willing to invest, is as important for the sector as technological and policy solutions to prevent and counteract climate change. It is, therefore, critical that utility companies transition from their traditional business models, based upon thermal generation, to more sustainable ones, based on renewable energy mixes.

Further studies should focus on the nexus between companies with a high percentage of thermal generation assets and their costs of borrowing, which could help to better explore the link between sustainability and the cost of capital within the utility companies sector. Another topic to study is the extent that policy and renewable technologies modify the sustainability perception of investors. The research would be further validated by carrying out more interviews or a survey.

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